A RAPID PHOTOGRAPHIC PRINTING APPARATUS.

The apparatus is designed to produce duplicates of drawings principally, which will be reversed as to color but positive as to letters, figures, writings, etc., without the use of a printing frame and with greater facility. It is also adapted to make positive prints from film or flexible negatives.

As will be noticed in the accompanying illustration, the machine consists mainly of two rollers, about three inches in diameter, similar to the rolls in an ordinary clothes wringer, mounted one above the other; the upper one is solid, covered with soft felting material, and runs in slotted bearings at each end, having pressure springs above to exert pressure on the lower roll. This latter is more complicated, but runs in solid bearings. It consists of a glass cylinder about one-eighth of an inch thick, having a metal plug in one end with suitable ventilation openings, and a shaft to fit in a bearing in the supporting frame. The other end of the glass roll is open and is held in position by outside roller bearings, supported in the frame. On the interior of the transparent roll is a shade held stationary, extending the full length of the roll, which has a slot in its upper part directly under the contact point of the two rolls. Supported upon another removable frame is an incandescent candle-shaped electric light bulb made long enough to equally illuminate the slot in the shade within the glass cylinder, or, in other words, to illuminate only the section of the drawing or film at the actual point of contact of the two rolls. The electric lamp is inserted at the open end of the glass roll. In the diagram showing a section of the glass roll below, the small circle is the electric light bulb, and the solid circle with a break in it the light shield. Gears at one end of the rolls cause the latter to rotate with equal speed. In front and behind the rolls are platforms arranged for feeding in the drawing as the rolls are rotated. It is highly essential in this machine that the rolls shall revolve with a continuous, steady music-box-like motion, in order that the light may act equally upon the whole sensitive surface.

An uneven movement will show in the form of lines across the print. It was found that a small electric motor produced the right effect, although the machine could be operated as well by a spring or weight suitably geared up. It will be observed the shaft of the small motor (similar to an electric fan motor) attached to one side of the platform has a spiral worm screw on its end which engages a gear wheel; from this gear the speed of rotation is still reduced by other

In operation the sheet of drawing is laid upon the platform, then over it is laid a sheet of slow bromide paper with the sensitive side upward, the motor is started, and the drawing and sensitive sheet are pushed or fed to the two rolls. The time of exposure, or

DETAIL OF CONSTRUCTION OF PHOTOGRAPHIC PRINTING APPARATUS.

APPARATUS FOR MAKING BROMIDE PRINTS WITHOUT A PRINTING FRAME.

of the passage of the drawing through, is about thirty seconds. The exposed sheet is then developed and duplicates are obtained by simply repeating the operation, all in a dark room. The time of exposure can be varied by inserting resistance in the motor circuit to make the motor rotate faster or slower if the drawing is thin or thicker.

In the case of film negatives, the intensity of the light may be reduced by interposing between the lower

as white, reading the right way, while the ground is black, or the reverse in color of the original.

INSECTS FOUND IN AMBER.

BY JACQUES BOYER.

Aristotle attributed to amber a vegetable origin; Averroes and Cesalpin believed it to be a species of camphor. Theophrastus considered it the fruit of a submarine plant. Dioscorides thought that it was a product of acacia, while Buffon took it to be the wax of the ant and hardened honey. To-day, according to the opinion of geologists, it can be asserted that amber is derived from the solidifying of the resin of a pine which grew near the Baltic region during the tertiary epoch. According to the approximate estimate of M. J. Sollas, the continents 400,000 years ago had a different orography, and all northern Europe from certain culminating points was under water. The peaks of the Apennines, the Alps, and the Pyrenees were alone visible. Prof. R. Klebs has advanced the theory that an island, or perhaps even a vast territory, existed, which communicated with the Scandinavian country and extended as far as the south of England. On that now submerged country there grew gigantic conifers, which exuded the precious yellow resin that both the Phoenicians and Romans were to use to enrich their dress and ornament their houses.

These trees rotted, and after a series of generations fossilized, leaving their effused sap, which formed little by little the immense beds of amber, which are being excavated to-day.

Fig. 1. This opinion is corroborated by certain specimens of amber containing vegetable debris, as one of the photographs shows. However, the most curious phenomenon of all is that the amber is the tomb of millions of insects. Thus is formed the most ancient entomological museum of the world.

Until now it has only been possible to give pictures more or less exact of insects surprised in their aerial dances by this viscous trap, more than four thousand centuries ago. However, now, thanks to the orthochromatics, we have been able to photograph these insects, although they are in specimens of amber of various depths, whose colorations vary from a light yellow to a dark brown. We reproduce here the exact specimens exempt from all explanation, and absolutely authentic.

On account of the new geological disturbances, the amber was imbedded in fields of lignite, where the

1.—A specimen of amber with vegetable debris. 2.—A Diptera surprised in its flight (magnified 3, 8). 3.—An amulet of amber secreting two gnats. 4.—Bruchida (magnified 3, 8). 5.—A Coccinilla enlarged three times its natural size. 6.—Perlida (magnified 1, 6). 7.—A Petrobius (magnified 2, 8). 8.—Blatta (enlarged twice). 9.—Sipula.

INSECTS FOUND IN AMBER.

interchangeable intermediate gears, until the right degree of movement is ascertained for a given thickness of drawing or negative to be run through. The diagram shows plainly the principle of the apparatus.

glass light roll and the negative one or two sheets of translucent celluloid. When the right thickness has been determined by experiment, duplicate prints may be made with certainty. By exposing through the back of the sensitive sheet the print shows the writing

waves unceasingly washed it out, only to be thrown back again on the shore, principally in the environment of Koenigsberg. It is by this magic mirror of these minute mummies that we have reflected the fauna of ancient times. The insects are very well preserved

because the oily ether killed them rapidly. Once they were engulfed by the wind in a "womb nobler than Cleopatra's," as the poets say. (Figs. 2 and 3.) For instance, look at this Diptera surprised in his flight, or the amulet of amber which embalms two gnats. Is not nature an admirable entomologist? What collector could arrange more artistically the legs of a frog in his collector's case?

Fig. 4. The microphotographies show the most common species of insects found in trees. Here also is a Bruchida resembling the Coleoptera and closely related to the Bruchida whose larvæ cause so much trouble to our peas, beans, and other grains. Here (Fig. 5) is also a Coleoptera, which one might take for a lady-bug killed only yesterday.

Fig. 6. Let us observe this Perlida with its reddish orthopteras, smoked wings and elongated body. Nothing is easier than to identify it with its photograph.

Fig. 7. The following picture, reproduced after a specimen taken from the cabinet of Dr. Capitan, is harder to explain. It is probably a Petrobius, which has moved in its death struggle, which would account for the indistinct outline of its body.

Fig. 8. We can distinguish the hairs on the legs of the Blattid. Besides, it would be extraordinary not to recognize in the tree this perfect type of cosmopolitan insect. Finally, among the Diptera, to which we alluded above, we have a great variety to choose from. For example, there is that magnificent Sipula (Fig. 9) whose species is distributed over the whole globe. One can distinguish even the nerves on the wings, and also his little broken legs, a proof that he fought desperately to escape death in that resinous and translucent sepulcher.

Let us admit, when we finish our visit to this the most ancient of entomological collections which mortal can dream of, that these butterflies, ants, and flies of amber, of which several resemble the species found in warm countries, are proofs that millions of centuries ago the shores of the Baltic had a tropical climate.

THE MAGNITUDE OF THE OIL INDUSTRY.

The total production of petroleum during the past year far exceeded that of any previous period of similar duration. This great increase over former years is fairly well apportioned, and occurred in practically all the individual oil-producing countries. If the flow of the wells in certain districts fell off, the decrease was more than counterbalanced by the discovery and exploitation of oil-bearing strata in other regions. The United States made great advances not only in total production, but in her percentage of the output of the world. During 1904 this country was credited with nearly 54 per cent of the total, which aggregated the stupendous number of over 219 million barrels of 42 gallons each. Of this quantity the United States produced 117 millions.

It is almost impossible to grasp the magnitude and extent of nature's bounty in this respect. The engraving published in this number of the SCIENTIFIC AMERICAN purposes to demonstrate graphically what it would mean if this enormous number of barrels of oil or their contents were gathered in one place, though it is difficult merely to conceive of such a possibility. If we could form a vast chain, each link being represented by one of these 42-gallon barrels, with all the units in contact with the two immediately next to them, we would have a band of such magnitude that it could be passed around the earth equatorially no less than five times, and even then there would still remain a length over a thousand miles. If all the oil contained in these 219 millions of barrels could be poured out upon the ground, it would be possible to cover with a thick film of oil a surface greater than the entire combined area of the States of Rhode Island and Delaware—something less than a hundred billion square feet.

If we should desire to place this vast quantity of liquid in a single tank, we would have to build a structure 1,500 feet long, 250 feet wide, and over 3,300 feet high, a huge rectangle beside which the greatest edifices constructed by man, modern or ancient, would dwindle to insignificance. As the engraving shows, the Park Row Building and even one of the great pyramids of Egypt can merely be used as units of measure when compared to this enormous receptacle.

To further illustrate the magnitude of the last year's production of oil, the artist has shown a student's lamp of the usual type, capable of holding the entire quantity of illuminating oil refined from the total output, and has compared with it the famous 1,000-foot high Eiffel Tower. The tank of this inconceivable illuminating device would be cylindrical in form, 1,200 feet high, and 650 feet in diameter, and would contain over 3,025,000,000 gallons of refined oil. If we should light this lamp it would burn steadily, night and day, for one month and would give forth in light 3,628,260,000 standard candle power; or to understand better the significance of a flame of this power, it would give light equal to that produced by nearly three million of the electric arc lights in general use.

Why Do the Hands of a Jeweler's Dummy Watch Point to 18 Minutes Past 8 o'Clock?

It seems to be a general impression that the exact minute when Lincoln was shot is marked by the hands of every jeweler's sign-watch—an impression which seems to have been given by jewelers themselves.

The baselessness of this yarn, which has gone all over the country, is to be seen at once from the fact that President Lincoln was shot by Booth at about 11:30 o'clock in the evening, and died about 10 o'clock the following morning. Therefore the clocks do not represent the time of the event. That they were not intended to represent such time is proven by the fact that jewelers' dummy clocks have shown that time since the early part of the century.

All the clocks prior to 1861 did not show that time any more than they do to-day. Some of them show five minutes of one, some fourteen minutes to nine and other positions, but in nearly all the hands are equidistant from the figure twelve. As far as 18 minutes after 8 or 18 minutes of 4 is concerned, this is probably used because in this position the hands are most symmetrical, the first being one-third the distance from 12, and the second two-thirds. In this position they leave a long sweep above for the imprint of the jeweler's name and address, and do not interfere with the diagram of the seconds dial when such is used.

How the Lincoln story got into circulation we do not know, unless it was the offspring of some reporter's imagination. It has undoubtedly been kept alive for business as well as sentimental reasons.

A certain dummy-clock maker in New York has obtained considerable advertising on several occasions by telling a story to reporters about a jeweler rushing into his father's place after Lincoln was shot, and asking him to paint the face on the dummy clock he had ordered at 18 minutes past 8 to represent the hour that Lincoln had died; that his father liked the position of the hands in that way and used it on subsequent clocks, making a stencil from which all markings were done. The story, as it goes round, in most cases is to the effect that after Lincoln was shot, a meeting of the National Jewelers' Association being then in session, the jewelers resolved to perpetuate the time on their signs, and the resolution was adopted to this effect; but inasmuch as there was no National Jewelers' Association at that time—in fact, there was no meeting of jewelers of which we have any record—the story is a yarn on its face, even if the proof was not clear that such a position of the hands had been common prior to 1861.

The Current Supplement.

The current SUPPLEMENT, No. 1565, opens with an article on the hydro-electric power plant of the Brembo River, by Dr. Alfred Gradenwitz. Excellent illustrations accompany his presentation of the subject. Mr. Louis A. Hicks' paper on Reinforced Concrete Construction is concluded. An excellent *résumé* of the purpose and construction of the Siphon tunnel is published. Mr. Schoop's exhaustive analysis of the Edison accumulator is concluded. The use of the earth in high-tension transmissions is discussed by Emile Guarini. An exhibition was held recently in Paris which was of more than usual archaeological interest. The instructive relics which were there exhibited are described and illustrated by the Paris correspondent of the SCIENTIFIC AMERICAN. Mr. S. F. Emmons concludes his historical summary of the theories of ore deposition. Henri Coupin writes on insect paper makers, tells how decayed wood is chewed and converted into pulp, and gives, besides, the details of the hornet's method of making paper. Some interesting expansion experiments, which can be cheaply conducted by anyone, have been devised by M. Rémy. These experiments are described.

Charles Craske.

Charles Craske died on December 17 at his home in Woodbridge, N. J. It was Mr. Craske who, in 1862, at the suggestion of Horace Greeley, first cast from a mold a page of the Tribune, and thereby became the inventor of stereotyping.

Charles Craske was born in London in 1822. He came to the United States in 1852 and settled in New York, where he started an electrotyping business. In a short time every big paper in the country had adopted stereotyping.

Winner of the Glidden Trophy.

It was due to a typographical error and the phonetic similarity of the two names that, in our recent review of the year, the credit of winning the Glidden trophy was given to a Peerless instead of a Pierce car. The Glidden contest was fully described in our issue of August 12, 1905, when the winning of the trophy was properly credited.

Lake Titicaca, the largest lake in Peru, and the highest navigable lake in the world, is to be tapped for the purpose of securing electric power.

Engineering Notes.

What shall be the cast of mind and what the mental equipment of the testing engineer? Upon the first of these topics it is difficult to say much that is positive. It is perhaps easier to say what kind of mind will not succeed in this branch of engineering. We will perhaps all agree that he should be independent, self-reliant, gifted with the power of analysis of facts as well as with the power of drawing conclusions from the data at hand. He should be ingenious in devising methods to demonstrate the points at issue and a careful observer of data. He must keep himself free from bias or prejudice and take especial pains that he does not deceive himself. He should be fond of experiment and have a genius for it. Many times during our nearly thirty years' attempt to do something in the line of the work of a testing engineer we have had occasion to paraphrase the Latin apothegm, and say: "Experimenters are born, not made." He should keep constantly in mind the end to which his experiments tend and understand clearly the effect of every step in the progress of his tests, and its influence on the final result. Above all, he should be a thinker. No man who, when a problem is presented to him, simply searches his memory for whatever he may have learned in the schools, or have perchance picked up in his reading which bears on his problem, has any especial call to be a testing engineer. We are quite ready to allow that the power of seeing analogies between your own problem and one that some one else has had, and perchance successfully solved, is a legitimate and useful, not to say time-saving, habit of mind. But the point we want to make is that the one who habitually and continuously approaches every problem through memory or by studying up what others have done is far less likely to succeed as a testing engineer than one who habitually attacks a problem by an analysis of its elements.

The designs of locomotive superheaters are chiefly due to Wilhelm Schmidt, who has developed two distinct arrangements, both of which are of that type in which a portion of the number of flues is utilized for superheating. The design most generally used abroad is known as the Schmidt smoke-box superheater. Its special feature consists in the use of a tube of large diameter leading from the fire-box to the front tube sheet, by which a considerable portion of the flue gases is delivered at a high temperature into an annular chamber at the front end, within which the superheater tubes are placed. The steam from the dry pipe passes into the rear end of a header, placed near the top of the smoke-box on the right side, which header is divided into a front and back portion by a transverse partition. From the back of the header the steam passes through the small superheater pipes to the rear end of a corresponding header on the left side, and from the front of that header through other superheater pipes to the front section of the right-hand header, and thence to the cylinders. The superheater pipes are curved to surround the gases flowing from the large tube, which then pass upward on each side and then into the smoke-box proper. As in all superheaters of this type, a damper is provided to close off the flow of gases through the superheater when the engine is shut off, as at that time there is no steam in the superheater pipes, and they would be damaged by the hot gases if they were allowed to pass through freely. While this type of superheater has been extensively used in Germany, it has only been applied to one engine in America (No. 548 on the Canadian Pacific Railway), and although the results obtained from it have been exceedingly satisfactory, and any desired amount of superheat can be obtained by an adjustment of the amount of gas passing through the large tube, it is doubtful whether it will actually make very much headway in this country. There is considerable complication in the front end, and a number of steam-pipe joints, which, while they have not given any trouble so far, are certainly objectionable, and since in the other design of superheater developed by Mr. Schmidt these difficulties are overcome, it appears probable that the latter, which is known as the smoke-tube superheater, will be the one generally employed.

To Our Subscribers.

This is the last issue of the year—the sixtieth of the SCIENTIFIC AMERICAN's life. Since the subscription of many a subscriber expires, it will not be amiss to call attention to the fact that the sending of the paper will be discontinued if the subscription be not renewed. In order to avoid any interruption in the receipt of the paper, subscriptions should be renewed before the publication of the first issue of the new year. To those who are not familiar with the SUPPLEMENT a word may not be out of place. The SUPPLEMENT contains articles too long for insertion in the SCIENTIFIC AMERICAN, as well as translations from foreign periodicals, the information contained in which would otherwise be inaccessible. By taking the SCIENTIFIC AMERICAN and SUPPLEMENT the subscriber receives the benefit of a reduction in the subscription price.